

CLAIMS

1. A phased array antenna assembly adapted for reducing severe radiation hazards to the human body, useful for transmitting and receiving signals while taking into account the indoor electromagnetic field strength, said antenna design comprising;
 - a. micro-strip small-size antenna;
 - b. switching device, having a communicating means with said antenna to select between receiving or transmitting modes, further having a selecting means for phase shift and the receiving/transmitting frequencies;
 - c. a controller adapted to receive inputs from said switching device comprising;
 - d. coordinating means, adapted to interconnect said switching device with a algorithm-based software; and
 - e. a memory queue that records the optimal path in each indoor environment to each of the associated nodes to said antenna assembly;

wherein said assembly is cost effective in that it is adapted for a indoor mass-utilization consisting of low cost materials and components, and further wherein said assembly radiates a limited electromagnetic field in a minimal measure required for communication.

2. The antenna assembly according to claim 1, wherein the indoor electromagnetic field is located in a closed construction selected from house, apartment, large vehicle, aircraft or ship, industrial space or office and further wherein said closed construction comprises a plurality of openings.
3. The antenna assembly according to claim 2, wherein the closed construction comprises obstacles selected from corridors, floors, ceiling, windows, doors or any combination thereof.
4. The antenna assembly according to claim 2, wherein the openings are selected from corridors, floors, ceiling, windows, doors or any combination thereof, and further wherein said openings are the wave guide slots.
5. The antenna assembly according to claim 1, characterized by the fact that the path loss (L) of the electromagnetic radiation is calculated by the equation:

$$L_1 = 32.1 - 20 \log_{10}(\chi |R_n|) - 20 \log_{10} \left[\frac{1 - (\chi R_n)^2}{1 + (\chi R_n)^2} \right] + 17.8 \log_{10}(X) + 8.6 \log_{10} \left\{ -\ln |R_n \chi| \cdot \left(\frac{\pi}{d} \right) \cdot \left(\frac{X}{\rho_{mn}^{(0)} d} \right) \right\}$$

wherein n is the mode number; R_n is the reflection factor for mode number n, and K_n is the wave number for mode n.

6. The antenna assembly according to claim 5, wherein

$$R_n = \frac{K_n - kZ_{EM}}{K_n + kZ_{EM}}$$

Is characterized by the fact that R_n is the reflection factor for mode number n , and K_n is the wave number for mode n .

7. The antenna assembly according to claim 1, characterized by the fact that the antenna creates a main beam lobe, in such a manner that $P_{ant} = P_0 + P_{ls}$ and $P_{ls} = f(L_1 * K_{rssi})$; wherein $P_0 = 0$ dBm, and P_{ls} – Path loss to the mobile.
8. The antenna assembly according to claim 1, wherein an ASIC protocol controls the antenna operation in such a manner that the antenna is adapted to fit with any RF protocol.
9. An antenna assembly according to claim 8, wherein the ASIC comprises the algorithm of the following steps:
- a. scanning with the first beam for first station;
 - b. receiving a signal and writing the RSSI;
 - c. proceeding to next beam direction;
 - d. getting a maximum. RSSI or received field strength from said station;
 - e. calculating the station virtual distance from the said antenna and adjusting the power level to the correct one;
 - f. registering the obtained RSSI and/or level in a memory, wherein the obtained is associated with the beam direction and with the station ID; and
 - g. scanning for a plurality of other stations as required.
10. The antenna assembly according to claim 9, additionally comprising the step of proceeding with other receiving and/or transmitting tasks.
11. The antenna assembly according to claim 8, characterized by the fact that the calculating step is based on the electromagnetic radiation equation:

$$L_1 = 32.1 - 20 \log_{10}(\chi |R_n|) - 20 \log \left[\frac{1 - (\chi R_n)^2}{1 + (\chi R_n)^2} \right] + 17.8 \log_{10}(X) + 8.6 \log_{10} \left\{ -\ln |R_n \chi| \cdot \left(\frac{\pi l}{d} \right) \cdot \left(\frac{X}{\rho_{bn}^{(0)} d} \right) \right\}$$

wherein n is the mode number; R_n is the reflection factor for mode number n , and K_n is the wave number for mode n .

12. The antenna assembly according to claim 8, characterized by the fact that antenna used is a cell-wall socket (CWS).
13. The antenna assembly according to claim 1 or to any of its preceding claims, adapted to indoor utilization, wherein either the antenna or its associated clients are interconnected to at least one common network.
14. The antenna assembly according to claim 13, wherein the network is implemented in a plurality of closed constructions, in such a manner that a network of one closed construction is in communication with at least one another network located in at least one other closed construction.
15. The antenna assembly according to claim 13, wherein a master operator (CWS) coordinates and/or communicates between pluralities of sub-networks.
16. The antenna assembly according to claim 13, characterized by the fact that while one master CWS is busy with an on-going session, selected from any fax, voice, data transaction or any combination thereof, another CWS is used as the coordinating master.
17. The antenna assembly according to claim 13, wherein the calling device identifies itself with its personal identification number (PIN) to the CWS, and wherein the free CWS will install the PIN as the calling party number for the exchange. This will cause correct billing of the PIN owner.
18. The antenna assembly according to claim 1, characterized by a phased array antenna comprised of n by m elements with horizontal - vertical and or circular polarization.
19. The phased array antenna as described in Figure 9.
20. The phased array antenna as described in Figure 10.
21. A broadband antenna assembly according to claim 1, adapted to operate at a frequency within the band gap of about 900Mhz to about 6Ghz.
22. The broadband antenna assembly according to claim 20, adapted to operate at a frequency within the band gap of about 2.4GHz to about 5.8Ghz.
23. The antenna assembly as defined in claim 1 or in any of its dependent claims, adapted for mirroring a plurality of main beam lobes; the symmetry of the mirrored beams is referred to a predetermined axis of the plate that comprises the element array.

24. The antenna assembly according to claim 23, wherein the axis is perpendicular to the plate that comprises the element array.
25. A phased array antenna according to claim 23, adapted for mirroring L beam lobes, wherein L is any positive even integer number, comprising
 - a. a plurality of RF input/outputs;
 - b. a plurality of RF switches;
 - c. $1:L$ splitter modules; and,
 - d. an array of n by m elements with horizontal - vertical and or circular polarization.
26. The phased array antenna according to claim 25, additionally comprising at least one switching module.
27. The phased array antenna according to claim 26, wherein at least a portion of said switching modules is in series.
28. The phased array antenna according to claim 26, wherein at least a portion of said switching modules is parallel.
29. The phased array antenna according to claim 26, wherein the switching module is an electronic circuit comprising *inter alia* a plurality of p RF signal inlets, a plurality of q RF signal outlets and a plurality of $p+q$ diodes, wherein p and q are any positive integer numbers; in such a manner that each of said $p+q$ diodes interconnects one of the q inlets with n outlets; wherein n is any positive integer so that $1 \leq n \leq q$.
30. The phased array antenna according to claim 27, wherein $p = q = 2n$.
31. The phased array antenna according to claim 26, wherein the switching module is an electronic circuit comprising *inter alia* a plurality of p RF signal inlets, a plurality of q RF signal outlets and a plurality of $p+q-1$ diodes; wherein q and p are any positive even integer numbers; each of said $p+q$ diodes interconnects one of the q inlets with n outlets wherein is $1 \leq n \leq q$ so that at least one beam is not mirrored.
32. The phased array antenna according to claim 26, wherein the switching module is an electronic circuit comprising *inter alia* a plurality of $q+1$ RF signal inlets, a plurality of $q+1$ RF signal outlets and a plurality of $(p+1)q$ diodes; wherein q is any even integer number in such a manner that each of said pq diodes interconnects one of the q inlets with p outlets; wherein a single central beam is not mirrored; wherein p is an integer number, and further wherein is $1 \leq p \leq q$.

33. The antenna assembly as defined in claim 1 or in any of its dependent claims, adapted for mirroring a plurality of L main beam lobes; the symmetry of the mirrored beams is referred to a predetermined axis of the plate that comprises the element array; said antenna comprising *inter alia* p RF input/outputs; the q inlets are interconnected with j outlets by means of each of said $p+q$ diodes; at least one RF switch; a plurality of $1:L$ splitter modules; an array of n by m elements with horizontal - vertical and or circular polarization and a plurality of s switching modules adapted for mirroring said plurality of L main beam lobes; wherein s , L , D denote the signal, beam and diodes and further wherein n , m , i and j are any positive integer numbers, and so that $is=2iB=4iD$.
34. A switching module adapted to double RF signals in power of p ; comprising *inter alia* a plurality of q RF signal inlets, a plurality of q RF signal outlets and a plurality of q diodes; wherein q is any integer number in such a manner that each of said q diodes interconnects one of the q inlets with pq outlets; wherein p is an integer number, and wherein is $1 \leq p \leq q$.